

IOWA'S FOREST HEALTH REPORT, 2007

By: Aron Flickinger, Forest Health Coordinator, DNR Forestry Bureau

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Introduction

Each year the Iowa DNR Bureau of Forestry cooperates with many agencies to protect Iowa's forests from insects, diseases and other stressors. These programs involve ground and aerial surveys, setting up sentinel trees, setting up pheromone traps, following transects for sampling, collecting samples for laboratory analysis and directing treatments for specific problems during the growing season. After each growing season, the Forestry Bureau issues a summary report regarding the health of Iowa's forests.

This year's report begins with a brief summary of weather events, followed by a summary of Forest Service Inventory data for Iowa's forests, showing that no oak tree is represented in Iowa's top 10 species, then survey summaries for insects and diseases that have the potential to impact Iowa's forests. The 2007 surveys for exotics insects and diseases were Emerald Ash Borer and Gypsy Moth survey. Oak tatters research describes some new intriguing information discovered in 2006. A Pine Shoot Beetle Quarantine has been implemented by USDA-APHIS-PPQ for Iowa in 2006 that still affects some businesses in 2007. This report finishes up by describing forest insects and diseases already present, and concludes with invasive plant species in our forests.

Weather

The beginning of March started out with 2 weekends in a row of snow/ ice storms that caused a lot of damage to trees throughout Iowa. Shortly thereafter, above normal temperatures at the end of March with an abrupt return to below freezing temperatures caused early stress on many tree species across Iowa. As a result, many tree species lost their flowers that create seeds either in the spring or fall. Species hit the hardest include apple, silver maple, river birch, hackberry, hickory, northern pecan and some oaks. During the week of April 23rd rain in the amounts of 3-4 inches caused flooding throughout riparian areas across Iowa.

For people that like to have a clean looking yard, there was not much from the large seed producing trees like oak and walnut to have to clean up. There was an ok red oak and black walnut crop throughout Iowa. Not very much white oak was produced after the large crop that fell in 2005. Hickory didn't produce much seed this year either.

Warmer winter conditions are allowing some insects to build-up their populations. Bagworms are becoming an increasing problem in southern Iowa by defoliating arborvitae trees.

Aerial Survey

Iowa forests surveyed by plane in 2007 were found to be in generally good condition. On August 2, the surveying crew started above Humboldt and flew south following the Des Moines River until it met up with the Mississippi River. From there the crew followed the Mississippi River north to Toolesboro, where they then followed the Iowa River back to Marshalltown. Observance along this route showed lots of flooding from overfilled rivers. Silver maple and cottonwood trees showed chlorotic symptoms in their leaves from their water saturated soils. Most counties along the route also showed signs of dutch elm disease (DED). A large population of lace bugs caused oak leaves to look discolored in late July thru August. Scattered trees were noticed north of Highway 30, with most of the affected trees occurring South of Highway 30.

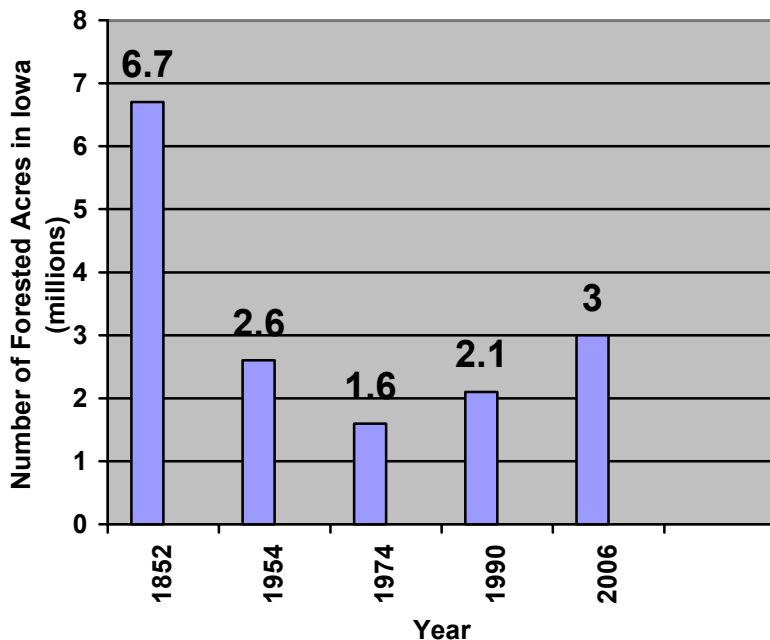
On August 3, the surveying crew started above Waterloo and followed the Cedar River to the south until reaching the Mississippi River where they turned north following the Mississippi River back up to the northern most corner of Iowa. The crew flew back to where the Upper Iowa enters the Mississippi and followed this river to the west. This day's route showed the same level or higher amounts of oak wilt/ oak decline, pine wilt and DED compared to observations along this same route in 2006.

THE SIZE AND CHARACTER OF IOWA'S FORESTED LAND

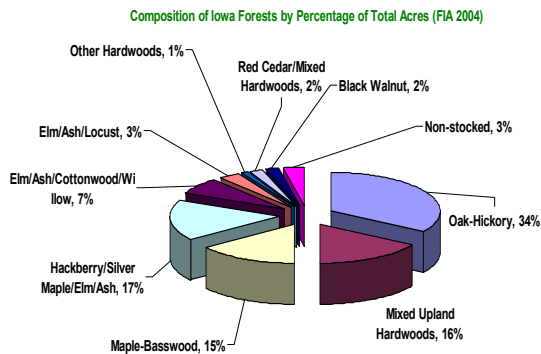
Iowa's forests are generally healthy and are increasing in the number of acres. A forest resource that is healthy contributes immensely to our state's goals of clean water, abundant wildlife habitat, lumber and veneer production, outdoor recreation and aesthetics that enhances the quality of life in Iowa for the citizen of Iowa.

Iowa has approximately 3.0 million acres of forested land representing a steady increase over the past few decades as shown in Figure 1 below. Forest conservation programs, reforestation programs and shifts in agricultural land use all contributed to an increase in forested acres. Most Iowa forests are native hardwood forests with oak, hickory, maple, basswood, walnut, ash, elm, cottonwood and many other hardwood species. Less than 3% of Iowa forests are conifer forests.

Figure 1. History of Iowa's Land Covered in Forest since Settlement.



Even though Iowa forests are increasing in acreage, the oak component is decreasing in acreage in some areas of the state, as forest succession drifts toward more shade-tolerant species such as maple in the absence of forest disturbance. There are currently 927,200 acres of oak-forest in Iowa. Iowa has lost an average of 4,500 acres of oak forest annually since 1990. At the current rate of decline oak forests will disappear from the Iowa landscape in 160 years. It is important for landowners to work with DNR Foresters to use silvicultural systems to counter this trend to regenerate oak. A breakdown of the different forest communities in Iowa is shown in the pie-graph below.



Succession to shade tolerant hardwoods eventually replaces shade intolerant hardwoods, like oak, in the absence of disturbance. Most of Iowa's oak stands are in the mature or over-mature age. Prior to settlement periodic prairie fires swept into the woodlands and eliminated mid-story layers, thus giving the thicker barked oak a competitive advantage over other species. That is largely why we have oak today. However, many of these stands are now 150+ years old. These stands may be reaching the twilight of their life span. Without fire or disturbance oak seedlings cannot get the light they need to survive. When the fire ecosystem is eliminated shade tolerant species like sugar maple are in a position to fill the void.

Other challenges to keep in mind about Iowa's oak forests is that oak's within the white oak group has a sporadic seed production, exception bur oak, only producing good seed crops once every five years on average. This makes the timing of silvicultural treatments or harvesting very important to the regeneration of oak stands. Another challenge for maintaining oak forests is the deer populations may be so highly concentrated that they eat oak seedlings and keep them browsed to a point where other less palatable species out compete the oak. Numerous researchers have determined estimates for ecosystem carrying capacity that range anywhere from 10 to 30 deer per square mile of forest habitat. The DNR Wildlife Bureaus' target is to have 170,000 deer after harvest which translates to about 350,000 deer prior to the hunting season. Iowa has about 3.0 million acres of forestland. That leaves us with about 75 deer per square mile before harvest and about 36 deer per square mile after harvest within our forests.

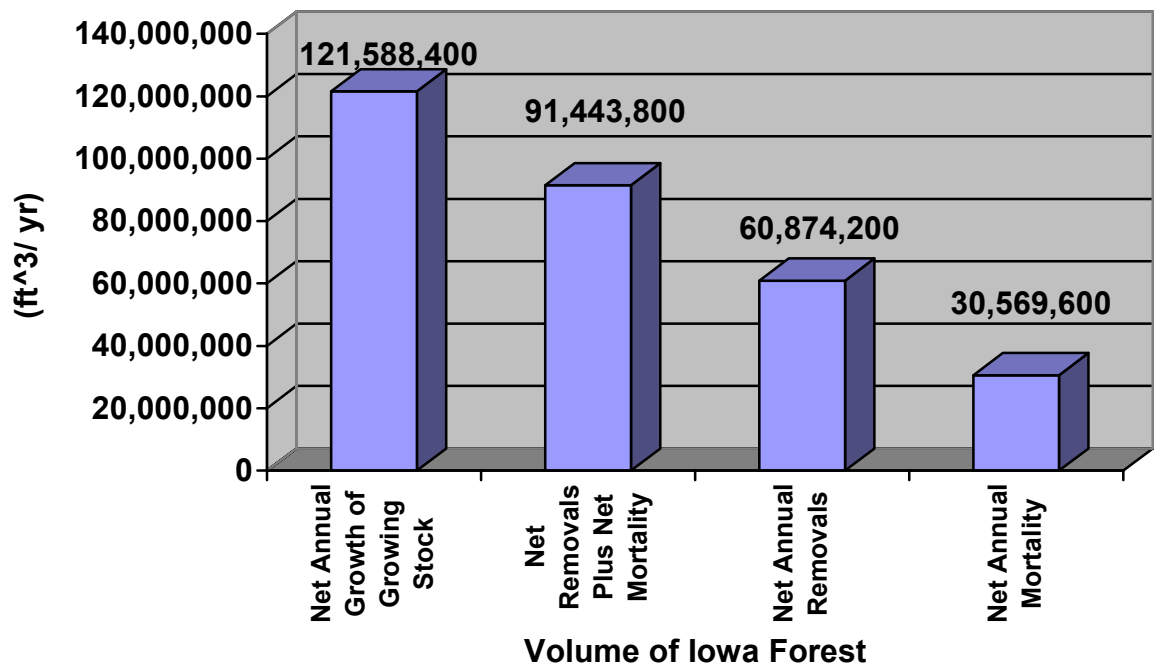
Fragmentation of forest land into smaller tracts with houses near or in the timber the management practice that can regenerate oak become less feasible for landowners, because they do not want to "ruin" there woods. Most people want to preserve their forests with big trees thinking that this will keep their forest in its current condition. The woodland becomes an extension off their yard not a forest. People generally believe that by doing nothing that they can preserve

their forest, when in reality it take disturbance to maintain an oak-hickory forest type. Many of the oak regeneration issues can be addressed through proper application of silvicultural techniques that a district forester can consult a landowner about.

Harvesting activities do not destroy the woodland wildflower and forb seed bank, even in heavily scarified sites. Plants such as Anemone, blood root, Blue cohosh, fern come back in reaction to the disturbance and additional light. They are more likely to disappear under a very dense canopy of shade tolerant hardwoods.

Even though Iowa's forest land is currently increasing, the land is becoming more fragmented and the species growing on the land is converting to more shade tolerant species. Iowa has about 8% of its land classified as forest, according to 2006 Forest Inventory Data provided by the Forest Service. That means about 3.0 million acres of Iowa is forested. Most of Iowa's forest land is privately owned, 90% by 138,000 landowners. In 1990 there were 55,000 forest landowners in Iowa that owned on average of 31 acres of forest land. By 2004 the number of forest landowners increased to 138,000 with an average of 12 acres of forested land. Development is fragmenting the forest cover in Iowa. This will make it more difficult to manage the forest resource, as there will be so many more people with different opinions on how they want their forest to grow.

Net annual growth exceeded the combined removal and mortality of Iowa's forestland by over 30 million board feet in 2006, the latest FIA data available. This data is shown in the following bar graph.



The graph and Table 1 in Appendix A shows based on 2006 FIA data, that 24% of our current forests are composed of tree species that are not expected to be long lived. Elm (Dutch elm disease), ash (Emerald Ash Borer) scotch pine (Pine Wilt) are all in peril because of insects and diseases that pose serious threats to their survival in the future. What will Iowa's forests look like for the next generation? Notice that no oak tree even cracks the top ten for species ranking.

The Value of Iowa's Forests

Over 300 businesses in Iowa utilize the wood grown in Iowa's forests. The forest products industry contributes over \$1 billion each year to Iowa's economy, including over 25,000 jobs for Iowans.

Many of the finest quality black walnut, oak and maple trees in the world are grown in Iowa. These trees are exported over seas to countries like China, Japan and Germany. Iowa is one of the leading states in the U.S. for the export of veneer walnut.

In 1999 Iowa's private landowners received over \$14 million in stumpage payments for their timber. That value rose to over \$22 million in 2007. Iowa's 300 Christmas tree growers sell over 50,000 trees annually, yielding more than \$500,000.

Emerald Ash Borer Surveillance Effort

The Emerald Ash Borer (EAB) is native to the Orient, and was introduced in the United States near Detroit in the 1990's. On December 1, 2006 a quarantine was placed by USDA-APHIS for the entire states of Illinois, Indiana and Ohio. The lower peninsula of Michigan is under this quarantine, also. The federal order prohibits the interstate movement of ash nursery stock, ash green lumber, and any other materials including logs, stumps, roots, branches, composted and un-composted chips. Due to the difficulty of distinguishing between species of hardwood firewood, all hardwood firewood is included in this quarantine.

Although not yet found in Iowa, EAB has more potential for future harm to Iowa forests and urban communities than any other insect currently being dealt with in the United States. EAB kills all ash species by burrowing under the bark and eating the growth (cambium) layers of the trees. EAB has been found capable of killing every species and size of ash tree in neighborhoods or woodlands. Ash is one of the most abundant native tree species in North America, and has been a preferred and heavily planted landscape tree in yards and other urban areas.

The Iowa Department of Natural Resources (IDNR) Forestry Bureau in cooperation with Iowa State University Extension (ISUE) and Iowa Department of Agriculture (IDALS) State Entomologist Office have been following the United States Department of Agriculture Forest Service (USFS) protocol to monitor Iowa for signs of the emerald ash borer (EAB). As per current United States Department of Agriculture's Animal Plant Health Inspection Service estimates, this exotic insect has caused the death or decline of over 25 million ash trees in Michigan, Indiana and Ohio since 2002. The detection of EAB in the Chicago, IL area in 2006 is a great concern because of its proximity to Iowa and Interstate 80 linking the two states. Further, the confirmation of EAB in Peru, IL in July 2007 places this insect only 85 miles away from Davenport, IA. According to recent sources, Iowa has an estimated 50 million rural ash trees (USFS 2006) and 10 million urban ash trees (USFS 2006).

Visual surveys:

A surveillance effort has been in place the past four years in Iowa to look for EAB. For 2004 and 2005, this activity consisted of visual surveys of urban ash trees (towns/cities with a population greater than 1000) in all 99 counties, visual inspection of ash saw logs at 43 sawmills, and ash nursery stock. Visual surveys in 2004 involved 2078 trees on 252 sites, and in 2005 involved 1318 trees on 238 sites.

During the 2006 and 2007 season, surveillance strategy shifted to the highest risk areas in the state, campgrounds. Sites were selected based on location near interstate highways, near tourism sites, and/or on the eastern border of Iowa. Up to 10 trees were examined in each campground for signs of EAB. The larger the campground and the greater the ash density, the more ash trees visually examined. In 2006, 417 ash trees were visually examined in 50 state and 10

county campgrounds. In 2007 EAB visual surveillance increased to 400 campgrounds (all federal, all state, all private and large campgrounds in 69 counties) involving 1102 trees. No evidence of EAB was noted during visual surveillance in Iowa (2004 – 2007).

Sentinel trees:

Sentinel trees in Iowa were created in one of two ways: girdling standing ash trees (4-13 inch DBH) or planting donated containerized ash trees (1-3 inch caliper). Sentinel trees were established by June 1 each season. In general, containerized trees were used for private campgrounds or in areas with few ash trees, while standing ash trees were used on federal, state or county properties. A tree was girdled by using a folding hand saw, making two cuts through the bark (4 – 6 inches apart), and then removing the bark with a drawknife between the cuts. Every effort was made to select standing ash either in the open or with exposure on two or three sides; trees were rejected as possible sentinel trees if they were within a forest stand.

Container ash trees (1.5 – 2.5 inch caliper) were donated by Earl May (Jason Rystrom, Shenandoah), Fleming Nurseries (Mark Fleming, Cedar Rapids), Miller Nursery (Jim Poulsen, Johnston), Country Landscapes (Ames) and TNT Nursery (Brett Schram, Ankeny). The trees were not planted properly and only received natural rainfall; these stresses were intended to make the trees more attractive to wood-destroying insects from the immediate surrounding area.

In 2005, **48** sentinel trees (23 standing, 25 container) on 12 sites were also used to monitor for EAB. In 2006, **68** sentinel trees (27 standing, 41 container) were established on 18 sites; 10 were retained for evaluation in 2007. In 2007, **237** sentinel trees (190 standing, 47 container) were established on 57 sites. During the fall of each year, sentinel trees were bark peeled on site (standing trees) or taken back to ISU (container) for processing. Whenever possible, new sentinel trees for monitoring the following season were girdled before leaving the site. EAB has not been detected in any sentinel tree to date.

USDA Experimental Traps:

During 2007, 100 experimental purple sticky traps were obtained from USDA for detection efforts in Iowa. Unfortunately, the attractive chemical (manuka oil) was not provided by the USDA, so trap catches would reflect beetles attraction to the color purple. Collaborators from 10 municipalities (Ames, Bettendorf, Cedar Rapids, Clinton, Davenport, Des Moines, Dubuque, Iowa City, Newton, and Waterloo) were given 10 traps and asked to place these at two sites (campground, green dump site, nursery, residential, and/or park) in the canopy of mature ash trees. Traps were installed by June 13; lift trucks were used on each site. Some collaborators checked traps as requested approximately one month after placement, collecting suspect beetles, recoating panels with Tanglefoot, and reinstalling traps in the canopy. All traps were removed by August 29, 2007, suspect insects collected, and traps were discarded.

Among the insects collected were 33 flatheaded apple tree borer adults from this trapping method, along with 3 native *Agrilus* species. These 36 insect samples were retained in ethanol. EAB was not detected on sticky traps.

EAB Outreach:

Educational efforts in Iowa during 2007 included the following:

- EAB posters, wallet size ID cards and fact sheets (USFS Pest Alert and USDA APHIS Green Menace) were provided to all EAB sentinel tree sites and campgrounds that were visually monitored.
- Bark peeling workshops were hosted in Davenport, Dubuque, and Muscatine in an effort to train city personnel on how to look for EAB in suspect trees.
- During visual survey work and sentinel tree establishment, collaborators visited with park rangers/facility managers about EAB, either updating them on this pest or providing initial education on identification, importance, firewood transport, and contact information. EAB information was provided.
- Presentations were made by collaborators to many audiences, including the U.S. Army Corps of Engineers Foresters, ISUE county meetings (Butler, Clinton, Linn), Weed Commissioners, Iowa Arborist Association, Iowa Turfgrass Industry and on ISU Campus (Horticulture faculty & Facilities Planning & Management landscape architects and grounds crews).
- EAB was the theme for the IDALS State Entomologist section at the Iowa State Fair.
- Firewood blitzes were conducted within a 10 mile radius of the new Iowa Speedway (Newton, IA) by APHIS, IDALS and DNR.
- Bulletin boards with the message of do not bring out of state firewood to Iowa were rented in SE Iowa – the area with the most out-of-state hunters. A single page fact sheet outlining the problems associated with bringing firewood to Iowa from out of state was placed in every out-of-state license application that was mailed (47,000 out of state hunters in Iowa annually).
- On-line registration for state parks included a message about not bringing firewood into Iowa if visiting from out of state.
- ISUE, APHIS and IDALS produced a 3-hour instructional Web cast (DVD) geared at informing cities about what steps to take to prepare for EAB. Topics covered: emerald ash borer (EAB) identification, life cycle, and current locations; Iowa's threatened resources; foreseeable regulatory actions and legal implications of EAB in Iowa; key components of EAB response; response strategies of impacted stakeholders; and 10 ways to prepare for EAB. This presentation is available at: <http://www.extension.iastate.edu/webcast/> (click on March 15, 2007).
- ISUE has a Web page dedicated to providing information to Iowa citizens on EAB. Items on this site include EAB Readiness Plan, Upcoming

Training Sessions, PowerPoint slide presentations with scripts, Shade Tree Alternatives, an EAB Image Gallery, and links to the national EAB Web site. The URL for this site is:

<http://www.extension.iastate.edu/pme/home/pests/EAB.php>

A map showing the current known locations of EAB in the United States can be viewed in Map 2 in Appendix B. Also in Appendix B, Map 3, shows the distribution of ash across the United States that is at risk to this exotic insect.

For more information on the most current status of the EAB log onto www.emeraldashborer.info.

The longer we can keep Iowa free of the emerald ash borer, the longer ash trees will still be a viable tree in the landscape. Hopefully researchers will soon come up with a better detection system and/ or a way to contain this destructive insect.

Gypsy Moth Survey

Gypsy Moth is a European insect species introduced into New England over 100 years ago as an experiment to help provide silk for the textile industry. This exotic insect continues to spread west from that introduction site and defoliate native forests wherever they become established. Establishment of gypsy moth in Iowa will affect the survival of our mature and oldest trees the most. The larvae of this insect will feed on the leaves of its over 300 host species during the summer removing a tree's ability to create food with its leaves. It is repeated defoliation that occurs several years in a row on the same trees that will deplete the stored reservoirs of nutrients the tree has, thus leading to the decline of that tree.

Gypsy Moth has established itself in eastern Wisconsin now, and is just beginning to move towards northeast Iowa. Through Iowa's trapping program and follow up treatments, Gypsy Moth has been kept from becoming established in Iowa, but there are now 5 counties (Allamakee, Clayton, Dubuque, Jackson, Clinton) within 60 miles of the gypsy moth establishment boundary line. Furthermore, Wisconsin is reporting that the gypsy moth population is building in neighboring Adams, Columbia, Dane, Marathon and Sauk counties.

The 2007 summer season provided the second largest catch of male gypsy moths in state history. There were 175 moths caught in 151 traps throughout the state, but most catches were made in NEIA, the area closest to the established population in WI. Many traps this year had multiple moths in them compared to previous years. More traps will be set-up in 2008 around the positive catches to be sure there is not a reproducing population establishing itself. The remaining moths were single catches, probably from hitchhikers from infested areas that dropped off in a campground or rest area in Iowa. Gypsy moth along with many other insects and diseases, can be easily transported from an infected state to a new location by firewood.

Weather patterns along with an introduced fungus disease for gypsy moth called *entomophaga maimaiga* and a federal program called “slow the spread” (STS) have combined to slow the spread of gypsy moth into Iowa. Budget cuts to the 2007 STS budget reduced treatments that were needed and as a result, the spread of this insect across Iowa will be faster than historical rates. Continued cuts to the STS budget are being proposed for the federal fiscal year 2008. For more information about the STS program visit their website at: <http://da.ento.vt.edu/index.html>

Map 1 in Appendix C shows the locations of the gypsy moth catches in Iowa for 2007.

A history of the number of gypsy moth catches and the number of acres treated for gypsy moth eradication in Iowa between 1970-2007 can be viewed in Table 1 of Appendix C. For more background information and the latest national maps for the movement of gypsy moth visit www.aphis.usda.gov/ppq/ispm/gm/.

Background Information

The Iowa Department of Agriculture and Land Stewardship (IDALS) in cooperation with USDA-APHIS-PPQ have conducted an annual male moth detection trapping program since the 1960's. In 2001 the Iowa Department of Natural Resources (IADNR) Forestry Bureau became involved with the gypsy moth trapping program because of budget cuts to the IDALS gypsy moth detection program. Forestry believes this is an important issue for Iowa's forest resource and has since provided labor in the form of its district foresters to help with the surveying of 57 of the 99 counties in Iowa.

Eradication Efforts

Eradication prevents establishment of the gypsy moth in new areas by eliminating isolated populations. Indications of isolated populations include: 1.) male moths caught in pheromone traps; or 2.) the presence of other moth life stages.

Eradication programs, utilizing insecticide spraying of a *Bacillus thuringiensis* (Bt) var. *kurstaki* are implemented by IDALS and USDA-APHIS-PPQ to eliminate the gypsy moth populations in Iowa. Bt is a pesticide derived from a bacterial toxin that affects only certain butterfly and moth larvae. A history of acreage treated with Bt since 1972 to eradicate gypsy moth is also shown in Table 1 in Appendix C.

IDALS in cooperation with IADNR, ISU and USDA Forest Service have conducted extensive professional and general public education efforts. These efforts have ranged from the publication of gypsy moth brochures and identification cards, to formal training programs for professional nursery, arborists and foresters, and workshops for the general public and volunteers.

Current

The gypsy moth trap locations in 2007 have been focused in cities, campgrounds, and around nursery operations. Along the Mississippi a trap was placed every 1500 meters to form a line of detection along Iowa's eastern border. Nine of our largest cities were also put on a 1500 meter grid.

In 2007 the following agencies were involved with gypsy moth trapping:

- U.S. Army Corps of Engineers (67 traps)
- City Foresters (63 traps)
- County Foresters (49 traps)
- U.S. Fish and Wildlife Service (12 traps)
- USDA-APHIS (1362 traps)
- IDALS (234 traps)
- IADNR (966 traps)
- Contractors (1894 traps)

Contractors were hired to get 40% of the traps set-up in time for the gypsy moth flight season in both 2006 & 2007. Five contractors were paid by the number of traps they set-up (\$7/ trap) and took down (\$5/ trap). If 95% of the traps were placed in the correct locations the contractor was rewarded an additional \$3/ trap. This gave the contractors an incentive to do the work properly, yet gave them the flexibility to do the work on their own schedule.

In 2007 there were 250 volunteer trappers that set-up a gypsy moth trap on their own property, providing additional survey coverage for Iowa. None of these traps caught a gypsy moth in 2007. It is easy to become a volunteer gypsy moth trapper by contacting:

Aron Flickinger
State Forest Nursery
2404 South Duff Ave.
Ames IA, 50010

As a volunteer trapper you will be sent a pheromone trap in May that can be hung with string or stapled securely to a tree. In September send the trap back to Aron for inspection. If it is determined that a population of gypsy moth is becoming established in your area, then a plan for spraying this insect will go into place. The more traps we can have volunteers set the better our surveillance for the movement of this insect into Iowa will be.

The following page is a summary fact sheet about a national program Slow the Spread (STS) that has been developed to slow the spread of gypsy moth into uninfested areas.



The STS Program

Slowing the Spread of Gypsy Moth to Protect America's Hardwood Forests



The Threat

Gypsy moth is a destructive, exotic forest pest that was accidentally introduced into the United States in 1869. It is currently established throughout the northeast and parts of the upper mid west (green shaded area on maps).

- It feeds on over 300 species of trees but oaks are most preferred.
- 75 million acres have been defoliated by gypsy moth since 1970.
- Gypsy moth defoliation causes extensive tree mortality, reduces property values, adversely affects commerce and causes allergic reactions in some individuals that come in contact with the caterpillars.
- Most (almost 70%) of the susceptible hardwood forests in the United States have not yet been infested by gypsy moth and are still at risk.

The Current Proactive Strategy

Since Congress funded the Slow the Spread program (STS) in the year 2000, ten states located along the leading edge of gypsy moth populations, in cooperation with the USDA Forest Service, have implemented a region-wide strategy to minimize the rate at which gypsy moth spreads into uninfested areas. As a direct result of this program, spread has been dramatically reduced from the historical level of 21 kilometers per year to 5 kilometers per year.

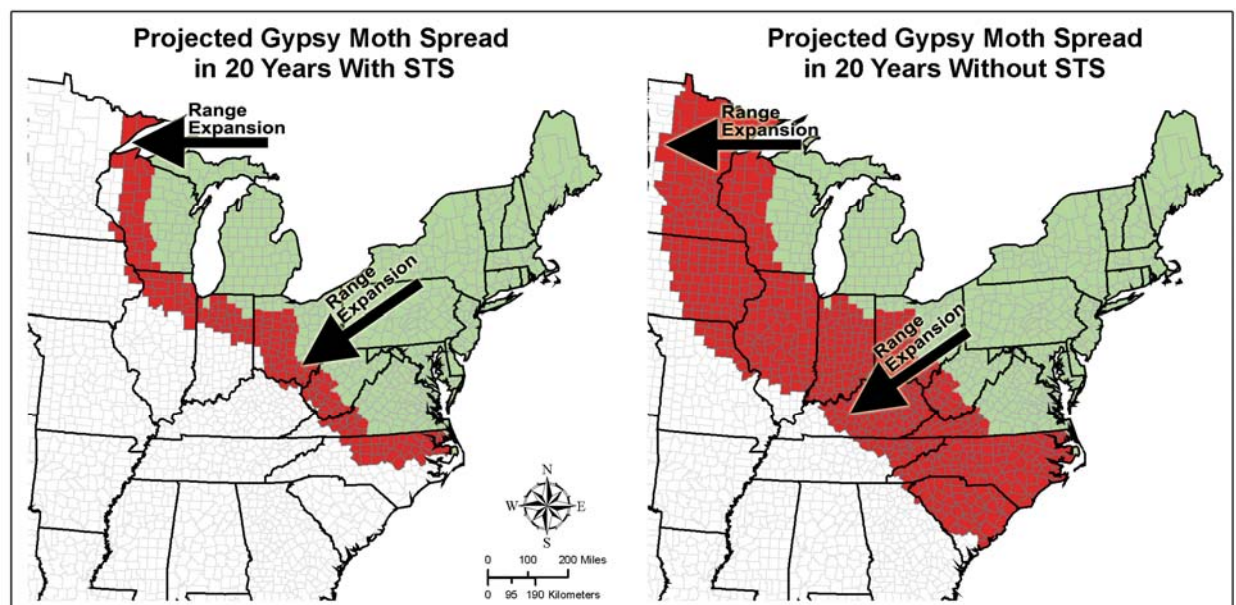
The Benefits

- STS reduces spread of this destructive pest to 5 kilometers per year and will prevent infestation of more than 150 million acres over the next 20 years (compare maps).
- STS protects the extensive urban and wildland hardwood forests in the south and upper mid-west.
- STS protects the environment through the use of gypsy moth specific treatment tactics.
- STS unifies the partners and promotes a well coordinated, region-wide action based on biological need.
- STS yields a benefit to cost ratio of 4 to 1 by delaying the onset of impacts that would occur as gypsy moth invades new areas.

The Funding

These benefits have been achieved with a partnership investment of state and federal funds averaging about \$13 million each year. Since its inception, the USDA Forest Service has supported the STS program as follows:

Year	2000	2001	2002	2003	2004	2005	2006
Dollars (in millions)	\$8.0	\$8.3	\$10.0	\$10.9	\$11.0	\$10.0	\$9.9



Green shaded counties are infested as of 2005 and red shaded counties will become infested over the next 20 years.

Lace Bug Outbreak

An aerial view of Muscatine County in August is pictured below showing the discoloration of oak trees from an outbreak of an insect called lace bug. Lace bugs feed on the undersides of leaves and during years of heavy feeding they can cause striking leaf discoloration in August and early leaf drop. Generally, lace bugs are not a problem year after year because natural enemies, such as lady beetles, green lacewings, and other predators help keep lace bug populations in check. Lace bugs do not normally threaten the health of woody plants. Continued heavy feeding on the leaves of the same trees could cause the decline of those trees if it occurs many years in a row.



Up-close view of the underside of a leaf showing the egg cases that hatched an insect called lace bug.



Tubakia

This disease has been found on bur oak trees over the past 3 years in Iowa. It shows up in late July or August showing discolored leaves especially along the interveinal tissue. It was reported by homeowners throughout Western Iowa and seems to become less numerous as you go east across Iowa.

In an effort to better understand the impact this disease is having on bur oaks each year, permanent monitoring plots have been established in 2007 at Loess Hills State Forest, Gull Point State Park and Thomas Mitchell Park in Polk county. Trees were mapped, rated for severity of infection, digital pictures were taken showing the condition of each tree and notes were taken about the presence of new leaves flushing as a result of this infection. Leaves were collected from each tree that was documented and bagged separately for the ISU Plant Insect Lab to diagnose what was causing the leaf discoloration. All the samples tested positive for Tubakia and negative for bacterial leaf scorch. Tubakia is generally not a problem to the health of a tree, unless repeated infection occurs on the same tree several years in a row. This could lead to the decline of trees with limited starch reserves.

Pictured below are sample leaves with typical signs of tubakia on a bur oak leaf.



Pictured below are trees with typical signs of tubakia on them. Notice a dead tree to the left, an infected tree in the middle and a healthy bur oak tree to the right. Is this disease causing the decline of these bur oak trees over time? A question we hope to answer in the upcoming years.



Pictured below is a bur oak tree that is re-leafing in August at Gull Point State Park. The concern about these trees using stored starch reserves at the end of the growing season is a concern to foresters because of how this will affect the health of that tree.



Sudden Oak Death

Phytophthora ramorum is the cause of the disease known as sudden oak death (SOD), ramorum leaf blight, and ramorum dieback. It is a non-native disease that was discovered in California in 2000. This pathogen has the potential to infect oaks and other trees and shrubs. For the latest information and a background of host species for this disease, visit www.suddenoakdeath.org.

The reason Iowa is monitoring for *Phytophthora ramorum* is because it is a quarantine pest and it may have been inadvertently introduced to all states outside the regulated areas of CA and OR on infested nursery stock in 2003-04 and again in separate incidents in 2004-05.

The Iowa Department of Natural Resources (IDNR) did not survey for this in 2007 because there have not been any positive finds in the Midwest between 2003-2005. Map 1 in Appendix D shows all the sites surveyed for this disease in Iowa from 2003-2005.

Plant disease personnel are still studying whether this disease could exist on oak in Iowa and be able to withstand the winters. Iowa is not in the lowest risk category for this disease to become established, but is one level higher.

Tatters Study in Iowa

Leaf tatters affects the leaves of trees causing them to look deformed or “tattered”. It causes newly emerged leaves to have reduced interveinal leaf tissue as the leaves grow larger. Tatters was first reported in Iowa, Indiana, and Ohio in the 1980’s and more recently in Wisconsin and Minnesota. Tatters has been reported on trees of all ages in rural and urban environments.

Not all trees become tattered because the leaves have to be exposed to the correct conditions after the leaves have emerged from their buds. The beginning stages of tatters is a curling of the young succulent white oak leaves as shown in the picture below.



It is answering the question of what conditions the leaves need to be exposed to that DNR Foresters have been studying for the past 4 years.

Foresters have not found insects or diseases when reviewing the damage caused by tatters. Current belief for the cause of tatters centers on environmental conditions that are causing farm chemicals to be moved off site and onto the leaves of trees. Could chemicals be volatilizing from the farm fields and getting onto the leaves or could the windy days in the spring time of Iowa be moving soil from agricultural fields with farm chemicals on them into the atmosphere and then adhering to the leaves of trees?

A study done in a lab at the University of Illinois in 2004 - 2006 has reproduced the same damage that tatters causes to oak leaves by directly applying a chemical called acetochlor at 1/100 rate during the leaf emergence phase on white and red oak trees. For a complete report on what the Illinois study has

found visit their web site:
http://www.nres.uiuc.edu/research/herbicide_research/index.htm

Here in Iowa, in anticipation of this annual tatters event on oak and hackberry leaves a team composed of many different backgrounds convened to plan activities for collecting compelling data to show what could be causing tatters during the spring of 2006.

The team decided to monitor on site weather temperature to watch for freezing or near freezing temperatures. This could help determine if leaves were being damaged as a result of cold temperature exposure. The team also decided to collect air, rain water and oak leaves during a six week period of time to see how the levels of acetochlor varied in relation to the tatters event that was happening. Two rural sites were set-up with these collection stations. One site was at White Pine Hollow and the other at a private residence near Iowa City. A final addition to the study was to protect part of a branch of a tree from the environment by placing a tree pollination bag around parts of several branches on an oak tree at each site. A picture showing the bags covering part of the branches at White Pine Hollow can be seen in the picture below.



Results

Leaf tatters at White Pine Hollow was observed on May 2, 2006 on many mature white oak trees. The previous site visit on April 27th noted that normal leaves on

white oak trees were emerging. It was also noted that a lot of field work and planting of corn in fields in Dubuque county was occurring.

Before leaving on April 27th, 5 tree pollination bags were placed over several branches on a white oak tree that had shown leaf tatters in past years. What happened during the 5 days between site visits has been what DNR foresters have been investigating for the past 3 years.

Viewing the pictures in the figure below, shows what foresters saw upon arriving at White Pine Hollow in May. The leaves that were protected from the environment showed no signs of tatters and looked normal. Conversely, notice the curling leaves that show obvious damage on the same branch, but not protected from the environment. This is tatters at an early stage- as time goes by the leaves develop without their interveinal tissue. Tatters can occur on the edge of a forest or in the interior. It occurs over the entire tree and it is not segmented to one side like what could be seen with drift damaging a tree on a windy day.



What may be happening is the acetochlor is applied on a corn field and then it volatilizes under the right weather conditions back into the air. Or the wind could be blowing soil particles covered with this chemical into the air. These particles then settle onto the leaves of trees throughout a forest or within a community. This can explain how all sides of a tree can be showing tatters damage and how trees on the interior of a forest can have tatters, not just the trees on the edges of a forest stand. If a trees leaves have advanced in growth enough before being exposed to elevated levels of acetochlor, then the leaves remain normal. The trees that escape getting tattered one year may not the next year. Along the same lines a tree that gets tattered in one year may not get tattered the next year. But if a tree gets tattered many years in a row, this stress can lead to the decline of that tree.

From April 10 through May 18 air, rainwater and leaf tissue samples were collected by DNR Foresters and analyzed at the University of Iowa Hygienic Laboratory yielded some interesting results.

The concentrations of acetochlor at White Pine Hollow quadrupled during this time from 15 ng/m³ to 55 ng/m³. During this span of time an over 15 ng/m³ increase occurred when tatters was first visually observed on site. For rainwater the concentrations went from almost non-existent to over 9.5 ng/ml by the time tatters was first observed, followed by a dramatic decrease by May 18th. Comparing leaf tissue levels of acetochlor between the bags shows the concentrations to be 5 ng/g or below for the leaves protected from the environment and concentrations 3 to 10 times higher on leaves that were not protected.

What does all of this data mean? It seems that looking at all of the data that elevated levels of acetochlor in the air and rain is occurring at White Pine Hollow. The peak levels of acetochlor occurring at the same time, or even a few days before the occurrence of tatters, looks very intriguing. No frost was reported on site during the occurrence of tatters. No freezing temperatures occurred during the 5 days the tree leaves were covered by the pollination bags. Cold temperatures were experienced previous to the bags being placed over the leaves- but all of the leaves/ buds were treated the same until April 27th. See Appendix F for a data table showing the values for the different farm chemicals that were measured on oak leaves in this study.

Future

DNR Foresters will continue looking at isolating methods for tatters to occur. One experiment will be to move oak and hackberry seedlings in and out of a freezer to see if tatters can be replicated by exposing these seedlings to cold temperature during the leaf unfolding phase. Another experiment to see if volatilization can cause tatters will be worked on with seedlings within a controlled greenhouse setting at ISU. Adding field work that involves monitoring wind blown soil particles from agricultural fields into the atmosphere and settling back onto the trees below as a source for getting the chemical onto the leaves of trees will also be done. The Iowa DNR is searching for further grants to better investigate this phenomena known as tatters to eventually be able to publish a scientific paper describing this complex problem.

Tatters 2007 Field Notes

[Here are the field notes for 2007 from Mark Vitosh, district forester for a private landowner site near Muscatine.](#)

4/18/07 2:40 pm

- White oak buds showing some swelling and bud breaking
- Dutchmen's Breeches flowering and may flowers 4 to 5 inches tall
- Hackberry buds still tight

4/26/07 1:20 pm

- New dead white oak un-marked west of the gate into pasture in timber along south side of trail

- Morel mushrooms 3 to 4 inches tall in timber, some yellows on south exposures
- Hackberry leafing out ½ inch to 1 inch long looking okay
- White oak small leaves ½ inch long look normal



White oak normal leaves

5/2/07 12:50 pm

- Big yellow morels on south-facing slopes
- white oak 1 to 3 inches long looking normal
- Hackberry leaves 1 to 3 inches long and normal



White oak normal leaves

5/9/07 2:20 pm

- Ag activity though out the area
- *Something has happened on the site since 5/2/07
- Temperatures did not fall below 51 deg. F between 5/2 and 5/9/2007.
- White oak leaves are damaged having some curling and/or purplish-brown edges. Some white oaks look significantly damaged.
- large white oak leaves not as damaged compared to smaller leaves 1 to 2 inches long.
- Hackberry small leaves 2 inches or less have typical cupping/ browning edges while leaves 3 to 4 inches or larger do not look damaged.
- A few black oak leaves showing damage
- Columbine, Sweet William, Wild Geranium, and May apples blooming



Damaged white oak leaf



Damaged hackberry leaf

5/17/07 4:00 pm

Sunny/Clear

Corn in area a few inches tall

-Hackberry a number of trees heavily damaged look very thin in crown and showing tatters

-White oak tatters is present and the degree of tatters is somewhat variable with some trees heavy and some very little. Trees with very little tatters have it mostly on the lower leaves. Some white oaks look very thin.

-Black oak some trees showing tatters. I have never seen this on black oak on this site since watching this site in 2002.



Tattered hackberry and white oak



Thin white oak crown

Black oak tatters

5/24/07 2 pm

Corn in area 5 to 8 inches tall

-Compared to Quad City/Davenport Site tattered trees in this stand look pretty thin and light colored, with some re-leafing but not significant yet

-Some new white oak leaves look okay and undamaged, but not all leaves look good with some still showing damaged leaves

-Hackberry new flushes look okay



Most white oak new flushes look okay still

White oak crown looks very thin



Oak tatters

Here are the field notes for 2007 from Mark Vitosh, district forester for landowners who live near Princeton.

4/18/07 9:20 am

-Adjacent crop field being injected with manure

-White oak buds starting to swell a little

-understory flowers flowering: spring beauty, blood root, Dutchmen's Breeches, and May apples and Trillium popping out of the ground

-Hackberry buds still tight

4/26/07 2:35 pm

Rainy cool day

-Hackberry starting to leaf out

-No activity in adjacent crop field

-White oak buds breaking/some leafing out and ½ inches long



White oak with buds breaking/leafing

5/2/07 2:35 pm

Partly sunny warm day

-Hackberry 2 to 3 inch long leaves that look normal

-White oak leaves normal 1 to 2 inches long

-Field activity in adjacent ag field

5/9/07 9:50 am

-There appears to have been activity in adjacent ag field

******something** has happened to white oak and hackberry leaves.

-Between 5/2/07 when leaves were normal and 5/9/07 when leaves started showing damage the low temperatures never fell below 51 degrees F.

-Hackberry leaves curled/edges off color with some green still in center of leaves.

-White oak small leaves 1 to 2 inches showing typical curling/purplish off color edges. ---Smaller white oak leaves 2 inches and less much more damage than larger leaves 4 inches and greater.

-White oaks along field edge and yard showing some leaf damage

-Red oak tree leaves showing some irregularities.



Damaged white oak



Damaged hackberry

5/17/07 11:50 am

Clear/sunny day

- Corn in adjacent field is a few inches tall
- Tatters on white oak, bur oak, a little on red, and hackberry
- Many of the large white oak look very thin in crown
- Big hackberry basically no leaves
- Some white oak and hackberry putting on new flushes
- Some black walnut showing black edges on leaflets



Thin crown on some oaks



Red oak with tatters



Hackberry with tatters



White oak tatters

5/24/07

Sunny warm day

-Corn in adjacent field 4 to 7 inches tall

-Hackberry new flushes look fine and crowns of trees starting to look fuller

-White oak new flushes look good in general, tatters still visible but trees starting to fill in with new leaves

-Marked white oak tree #367 died



5/9/07 Damaged white oak leaf tatters



5/24/07 Same white oak leaf with



Marked white oak tree #367 died



Tattered white oak with new flushes looking okay

[**Here are the field notes for 2007 from Mark Vitosh, district forester for a landowner who lives near Iowa City.**](#)

4/19/07 4:20 pm

- Frost damage on multi-flora rose, cherry, and gooseberry
- Bur oak buds starting to expand and break with some leaves actually opening
- Hackberry buds are still tight
- Corn field to west still in stubble

4/26/07 11:40 am

- rainy cool day
- Bur oak leafing out ½ to 1 inch long
- Hackberry buds starting to expand
- Corn field to west still in stubble



Bur oak leaves starting to expand

5/2/2007 8:10 am

- Tagged some bur oak on north and south side of the property
- Bur oak near north fence has catkins hanging and leaves 1 inch in length, leaves look normal
- No activity at this point in field adjacent to north fence
- Hackberry near west boundary fence leaves are ½ inch to 2 inches long and look normal
- Bur oaks near west fence leaves look normal 1 to 3 inches long
- Chestnuts near west fence have normal leaves 1 to 2 inches long
- Bur oak near south fence has normal leaves ½ inch long



Normal bur oak leaves

5/9/2007 4:10 pm

- Sunny
- Bur oak near north fence with leaves 3 to 4 inches long showing no damage or tatters at this point, leaf marked 1
- Bur oak with X near west fence has 3 to 4 inch long leaves that look okay
- Some young bur oak seedlings on ground near X tree showing some browning on leaves
- Hackberry near western fence showing some brown on the edges
- Bur oak near south fence 2 looks fine in general
- Chestnut leaves O look fine
- Some hackberries near south fence showing browning on leaves
- No field activity immediately adjacent to south fence



(1) Bur oak normal leaves near north fence Hackberry browning on edges

5/18/07 8am

- Sunny clear day
- Local weather station indicated the lowest temps at 45 deg. F between 5/9 and 5/18
- Corn is up adjacent to north fence a few inches tall
- (1) Large Bur oak near north fence showing light tatters mostly on lower leaves. Did not see any browning before tatters this time. (Most likely because 9 days between visits) Small bur oak along north fence looks more tattered than large tree
- (X) bur oaks near west fence look good in general with a few smaller leaves showing just a little tatters. Hackberry in this same area had some tatters on trees that showed browning the week before.
- (O) Most of the chestnut looks okay few leaves with missing parts but not sure if tatters
- (2) Bur oak near south fence look pretty good in general. Beans in adjacent field
- Large hackberry near south fence looks in bad shape



Bur oak leaf normal 5/9/07 (1) Same Bur oak leaf with tatters on 5/18/07



Hackberry near south fence



Hackberry tatters

5/25/07 4:30 pm

-Sunny cool day

-(1) Bur oak no new leaves on big tree yet. Little bur oak along north fence putting on new leaves that look okay.

-Some Hackberry on site still struggling and beginning to re-leaf



Tattered bur oak along north fence with new leaves undamaged

Summary for landowner who lives near Iowa City

Tatters was not at all as bad as it was overall compared to 2006. There was very little tatters on bur oak near the west and south sides of the boundary fences. There was tatters on bur oak along the north fence and this was the only field that was planted to corn in 2007. The west and south fences were adjacent to bean fields in 2007. Many of the hackberry showed some tatters in 2007 no matter what their location was.

Pine Shoot Beetle

The pine shoot beetle (*Tomicus piniperda* L.) is an introduced pest of pines. It was first discovered in the US at a Christmas tree farm near Cleveland, Ohio, in July 1992. A native of Europe, the beetle attacks new shoots of pine trees, stunting the growth of the trees. The pine shoot beetle may also attack stressed pine trees by breeding under the bark at the base of the trees. The beetles can cause severe decline in the health of the trees, and in some cases, kill the trees when high populations exist.

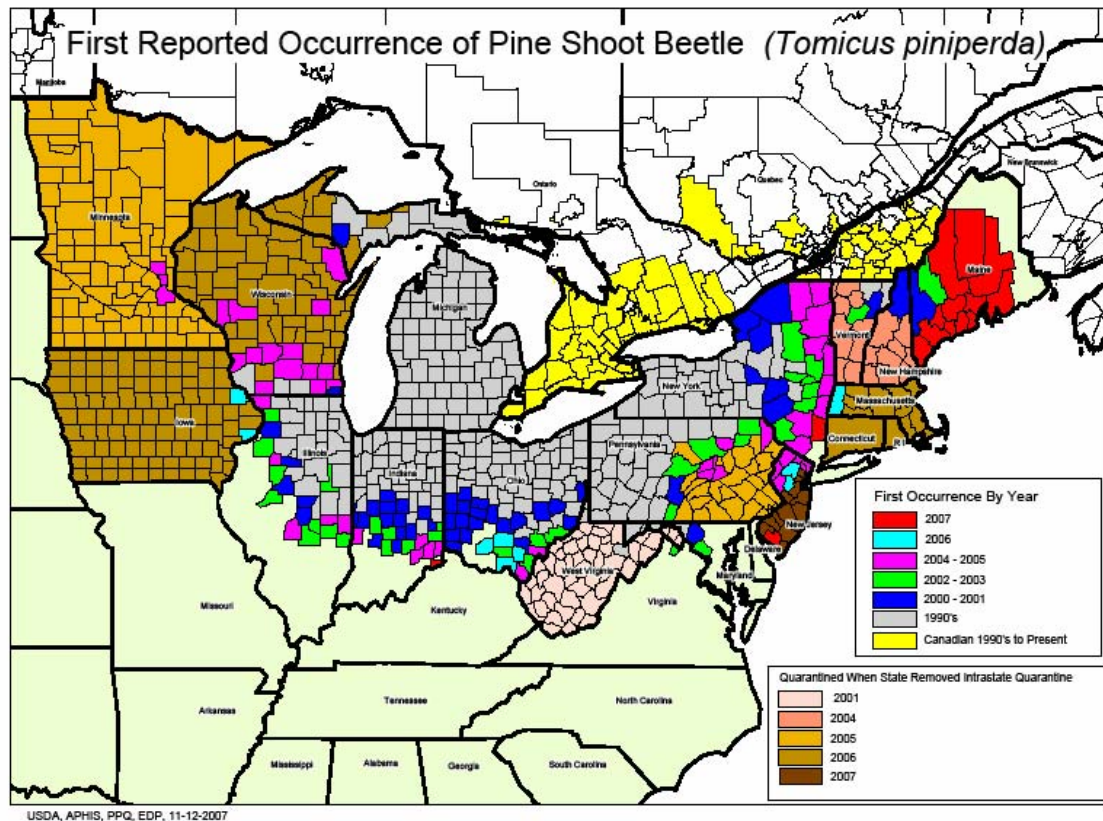
In May, 2006, USDA-APHIS-PPQ confirmed the presence of pine shoot beetle (PSB) in Dubuque and Scott counties. A Federal Order was issued effective June 22, 2006 placing Dubuque and Scott counties under a Federal quarantine for interstate movement of PSB regulated articles. Iowa Department of Agriculture and Land Stewardship (IDALS) was provided a copy of the Federal Order as well as additional information concerning the pine shoot beetle, and was requested to consider placing a state PSB quarantine for intrastate movement of PSB regulated articles from Dubuque and Scott Counties. However, after considerable review, IDALS declined to implement an intra-state quarantine for PSB. Therefore, a Federal Order was issued effective September 18, 2006 for quarantine of the entire state of Iowa for PSB, *Tomicus piniperda*.

The quarantine affects the following pine products, called “regulated articles”:

- Pine nursery stock
- Pine Christmas trees
- Wreaths and garlands
- Pine logs/lumber (with bark attached)

All pine nursery stock shipped from Iowa to a non-regulated state must be inspected and certified free from PSB. This inspection and certification must occur just before shipping. Small pine seedlings (less than 36 inches tall, and 1 inch in diameter) and greenhouse grown pines require a general inspection of the whole shipment. All other (larger) pine nursery stock shipments must have 100% tip-by-tip inspection.

The map below shows the areas that are quarantined for the pine shoot beetle.



As a result of this quarantine there are restrictions on nursery stock producers and Christmas tree growers.

Nursery Growers

- Pine nursery stock and other pine regulated articles produced in Iowa, and other PSB-quarantined areas can move freely among the quarantine areas, barring other state-required phytosanitary and plant pest regulations.
- Pine nursery stock (and other regulated articles) growers AND distributors wishing to ship regulated articles outside of Iowa must contact USDA, APHIS, PPQ, Des Moines, 515-285-7044, as soon as possible to make arrangements for inspections, and possibly enactment of compliance agreements, to ensure that seamless shipping activities can occur this shipping season.
- Pine nursery stock and other regulated articles produced outside the quarantine area, moved into Iowa and then out to a non-quarantined final destination, are also subject to quarantined requirements, as if they had originated from a quarantined area.

Christmas Tree Growers

- Christmas trees, wreaths, garlands and other pine regulated articles produced in Iowa, and other PSB-quarantined areas can move freely among the

quarantine areas, barring other state-required phytosanitary and plant pest regulations.

- Growers of Christmas trees and other regulated articles AND distributors wishing to ship regulated articles outside of Iowa must contact USDA, APHIS, PPQ, Des Moines, 515-285-7044, as soon as possible to make arrangements for inspections, and possibly enactment of compliance agreements, to ensure that seamless shipping activities can occur this shipping season.
- Christmas trees, wreaths, garlands and other pine regulated articles produced outside the quarantine area, moved into Iowa and then out to a non-quarantined final destination, are also subject to quarantined requirements, as if they had originated from a quarantined area.

For more information on the biology of PSB, a description of the insect, and symptoms on trees, review this website at:
<http://www.aphis.usda.gov/ppq/ispm/psb/>

If you suspect that you have PSB, you may collect a sample and send it to USDA, APHIS, PPQ, 6000 Fleur Dr., Des Moines, IA 50321, or contact USDA-APHIS-PPQ at 515-285-7044. If you think that you will be shipping out of the quarantine area, contact USDA-APHIS-PPQ at 515-285-7044 to set up an appointment to have your facility inspected for PSB.

PSB has only been detected in Scott and Dubuque Counties, however the whole state is under federal quarantine, in response to the decision made by the State of Iowa Department of Agriculture that an intrastate quarantine will not be implemented. Without an intrastate quarantine, USDA must assume that PSB is spreading to other Iowa counties and thus place a quarantine on the entire state, which restricts the movement of all regulated articles such as Pine nursery stock, Pine Christmas trees, Wreaths and garlands, Pine logs/lumber (with bark attached) into non regulated areas.

Additional information on the pine shoot beetle, such as background information, biology, regulations, fact sheets, federal orders, quarantine maps, etc.

USDA's main website for Pine shoot beetle is:

<http://www.aphis.usda.gov/ppq/ispm/psb/>

Fact Sheet

http://www.aphis.usda.gov/lpa/pubs/fsheet_faq_notice/fs_phpsb.html

Federal Order for Iowa

<http://www.aphis.usda.gov/ppq/ispm/psb/regs.html>

Federal Regulations for PSB

<http://www.aphis.usda.gov/ppq/ispm/psb/psbcfr06.txt>

PSB Quarantine Map

<http://www.aphis.usda.gov/ppq/maps/psbquarantine.pdf>

Hickory Mortality

Hickory decline, particularly of bitternut hickory and shagbark to a lesser extent, has recently been noted in Iowa, Missouri, Wisconsin, Minnesota, Ohio, Maryland, New York, Pennsylvania, West Virginia and Ontario (from various sources, including FHM data, state reports, and personal communication). Widespread mortality of hickory has historically been attributed to outbreaks of the hickory bark beetle (*Scolytus quadrispinosus*) during extended periods of drought. Hickory bark beetle is considered the most important pest of hickories. Past land use and soil fertility have been shown to indirectly determine outbreaks of the bark beetle. In 1994, a newly discovered fungus was reported in discolored wood and sunken bark cankers associated with beetle attacks. This fungus, *Ceratocystis smalleyii*, and a new sister species (*C. caryae*) were recently described by researchers at Iowa State University. Both species of *Ceratocystis* were pathogenic on 2-year-old hickories in greenhouse studies. The researchers suggested that *C. smalleyii* might play a significant role in hickory mortality. *Phomopsis* galls, *Armillaria* root rot and a flatheaded woodborer (*A. otiosus*) have also been associated with declining trees.



Dead and dying bitternut hickory in Carley State Park, Minnesota, August 2006.



Stem of declining hickory, with sunken, tarry spotted bark on lower and opened canker on upper.

Hickories are an important component of many forest associations in the eastern United States, particularly various oak-hickory cover types. Sites impacted by hickory decline and mortality have been reported to lose a high proportion of the hickory over a very short period of time (3 to 5 years), causing a significant adverse impact to wildlife, timber value and diversity on the sites.

Management and Control

Because hickory traditionally has not been a highly demanded timber species, very little attention has been given to assessment of hickory problems or development of management recommendations. Scientific information on the

biology or appearance of pathogens on hickory is very limited. There is clearly a lack of information on basic diagnosis and management of hickory diseases.

Medium and Long Term Goals

The following activities are being considered by scientist with the Forest Service to help reach a better understanding of the cause and magnitude of the problems with hickory:

- Survey to determine the distribution and severity of damage.
- Field evaluations of affected ecosystems to determine the cause(s) of mortality, and the involvement of climatic, edaphic and cultural factors. It is important to determine whether the causes are consistent among affected sites.
- Determination and documentation of the role of *Ceratocystis sp.* and other pathogens in hickory mortality.
- Participate in development of management guidelines to assist land managers in reducing losses in their hickory resource.
- Develop publications and other communication tools to regarding hickory mortality.

2007 Field Evaluations

Surveys were conducted in 14 stands in 3 states (IA, MN, WI) between 14 May and 28 August 2007. Based on basal area estimates, 12 of the stands are currently overstocked ($> 60 \text{ m}^2/\text{ac}$). In general, abundant hickory regeneration is occurring in all but two stands. A range of variability was found in frequencies of declining and of dead hickory in the surveyed stands based on the condition of each hickory within 10 m of systematically determined points on three transects (10 points per transect) in each stand. Frequencies of each condition class ranged from 83% apparently healthy with 10% declining and 7% dead to 0% apparently healthy with 15% declining and 85% dead.

Processing of Field Samples

Fungi obtained from trees sampled in 10 declining hickory stands in the three states in summer 2006 were identified as *Ceratocystis smalleyi* (19 isolates), *Fusarium solani* (15 isolates), and *Phomopsis* spp. (4 isolates). *C. smalleyi* was commonly isolated from trees with evidence of hickory bark beetle activity; *F. solani* was associated with sunken, annual cankers. To date (31 August) in the 2007 survey, *C. smalleyi* and *F. solani* have been isolated from similar numbers of trees (11 and 13, respectively) and isolates commonly obtained (25 and 29, respectively) from 6 stands.

Role of *Ceratocystis* spp. and Other Fungi

Main stems and/or branches of sapling and pole-size bitternut hickory were inoculated with two isolates of each fungal taxon in late May 2007. The first evaluation for lesion or canker development will occur in October 2007. The contamination frequency of hickory bark beetles carrying *C. smalleyi* is being determined for adults captured in window flight traps during June and July in a stand of declining bitternut hickory. Frequencies of ambrosia beetles carrying *Fusarium* spp. and of hickory bark beetles carrying *C. smalleyi* will also be

determined for adults emerging from logs from declining trees in the same stands.

Insect Trapping

a) *Window flight traps* were used to trap dispersing hickory bark beetles in crowns of four clusters of two to three declining, pole-size bitternut hickory between late April and early August 2007. Of 8 traps deployed, 39 hickory bark beetles were trapped in 7 between 15 June and 27 July. Highest weekly catches were during the last two weeks of July. b) *Emergence traps* were used to capture insects exiting log sections taken from trees sampled as part of the field survey. For logs processed to date (9 stands), the most common insects emerging were hickory bark beetles (373 from 6 sites) and an ambrosia beetle-like scolytid (31 from 4 sites). At least five different species of wood-borers (not yet identified) emerged in much lower numbers from the same set of logs.

Summary

Although hickory decline and mortality were found in all stands, healthy hickory regeneration was found in all but two stands. The fungus *F. solani*, with no known report of causing cankers on *Carya* spp., was commonly isolated from sunken, annual cankers that were often numerous on affected hickory stems. We hypothesize that hickory mortality in IA, MN and WI is due to a decline complex of interacting predisposing, inciting and contributing factors whose biotic and/or abiotic agents are interchangeable.

INVASIVE PLANT SPECIES

Invasive species are plants that are non-native to an ecosystem and cause or are likely to cause economic or environmental harm to humans, crops, livestock or natural plant and animal communities. Some examples of non-native species found to be a problem in Iowa forests are buckthorn, garlic mustard, honeysuckle and multiflora rose. These invasive and exotic plants are out competing native forest species, diminishing fisheries and wildlife habitat, reducing water quality, reducing economic returns from forest management and tourism, and threaten long term forest sustainability and bio-diversity. A list of invasive plants known to exist in Iowa is provided in a table located in Appendix E.

A website facilitating the training and participation of volunteers, public educational and outreach efforts, for the entry and management of volunteer generated data for Iowa have been created. The website is www.nrem.iastate.edu/invasive_species.

The Forestry Bureau is committed to developing better awareness about invasive species and their presence on both public and private lands. The Forestry Bureau works with MIPN, a regional group consisting of natural resource professionals employed by public and private organizations that are monitoring for invasive plants in the Midwest. Visit the MIPN website at www.MIPN.org for more detailed information on prevention and management strategies for invasive plants.

Additional web resources for learning about invasive species are:

- Center for Invasive Plant Management- www.weedcenter.org > Invasive Plant Management on-line textbook
- National Invasive Species Information Center- www.invasivespeciesinfo.gov
- USDA-APHIS web site- www.invasive.org
- Forest Service web site: www.na.fs.fed.us/fhp/invasive_plants/links/index.shtm
- Natural Resource Conservation Service web site: <http://plants.usda.gov>
- Woodland invasive species in Iowa brochure produced by Iowa State University- <https://www.extension.iastate.edu/store/ItemDetail.aspx?ProductID=6497&SeriesCode=&CategoryID=&Keyword=invasive%20species>

New invasive plants detected in southern Iowa in recent years include kudzu (*Pueraria sp.*) and salt cedar (*Tamarix sp.*). Jeff Chase, the weed commissioner for Des Moines County, noticed salt cedar growing in a roadside ditch during the summer of 2005. Jeff noticed that beneath the salt cedar the ground was barren. This invasive plant is a problem because it produces so much salt that it changes the soil chemistry, making it difficult for other plants to survive in that location. Later that summer he sprayed the salt cedar in a roadside right-of-way with

Habitat® herbicide (imazapyr 28.7%), a chemical labeled for aquatic use. The following year, Jeff found that the salt cedar had not grown back.

During the summer of 2006, federal and state officials made contact with the adjoining property owner to the roadside that contained salt cedar, and discovered a core area of salt cedar approximately 10-20 acres in size. The property owner is willing to hire a contractor to remove outlier populations during the spring of 2007. Much of the core area is in an aquatic habitat situation, making complete removal in this area difficult. As a result USDA-APHIS-PPQ applied for a permit to introduce a biological predator of salt cedar, a beetle called *Diorhabda elongata*, to start a slow but hopefully effective long term solution to this infestation. Follow-up surveys down river and at similar facilities are planned to see if this invasive plant is getting established in other locations in Iowa.

Kudzu is established on private property in Southern Iowa. An area about ¼ acre in size was discovered in Lucas County in the spring of 2006. The landowner is receptive to allowing monitoring of this plant as an educational tool for people to learn how to identify it. This will also be a “test” site to see how well this invasive plant adapts to Iowa’s climate. Currently, it does not appear to be spreading outside of its original boundary.

The Iowa DNR Forestry Bureau was able to get the Governor’s office to declare June as “Invasive Species Awareness Month”. The Trees for Kids program chose invasive species as their theme for 2007. This program provided 18,000 packets and posters for teachers to educate Iowa children about invasive plants they may encounter in their communities.

The Iowa DNR Forestry Bureau will continue to use fire to set back invasive populations of honeysuckle, multi-flora rose, garlic mustard, buckthorn and others species on state lands. Specific areas with important ecological significance have been identified, and the native plant communities are expected to benefit from having a prescribed fire. Prescribed fires favor native vegetation and set back the invasion of many undesirable plants.

Controlled burns at Backbone State Park to set back garlic mustard began in the Spring of 2005. Pictures from Backbone are shown below.

Before burning in Spring at Backbone SP= garlic mustard



After burning in Spring at Backbone SP= spring beauty, yellow bellwort and geraniums



CONCLUSION

Management plays an important role in creating a healthy Iowa forest. The best insurance a person can have when managing their woodlands is a diverse woodland that does not have more than 10% of any one species represented. Iowa forests provide an important role by providing abundant forest products and amenities, including outdoor recreation opportunities, wildlife habitat, water quality, and the economic benefits of a vast array of wood and wood fiber products.

Future Iowa forests will be impacted by invasive species that are already establishing themselves in the woodland understory or are within a neighboring state. No longer will passive management allow for woodlands to be “preserved” in the condition they are in today. Learning about your woodlands and how each component affects another will make it easier for Iowa’s woodlands to be managed for long term health. If you need technical assistance with your woodlands contact your district forester for assistance at <http://www.iowadnr.gov/forestry/district.html>.

The Bureau of Forestry, through cooperation with other agencies has programs in place to monitor forest stressors which have potential to move into Iowa and damage our forests. Those programs operated vigorously during 2007, and plans are in place for similar, continued vigorous forest health program operations in 2008.

I would not be able to produce all of this information or complete all of the survey work that I am involved without the help of my colleagues from USDA-APHIS-PPQ, Iowa State University Extension, Iowa Department of Agriculture and Land Stewardship, and Department of Natural Resources Foresters. **Thanks!**

Appendix A

Number of Trees in Iowa on Forestland (FIA 2005)

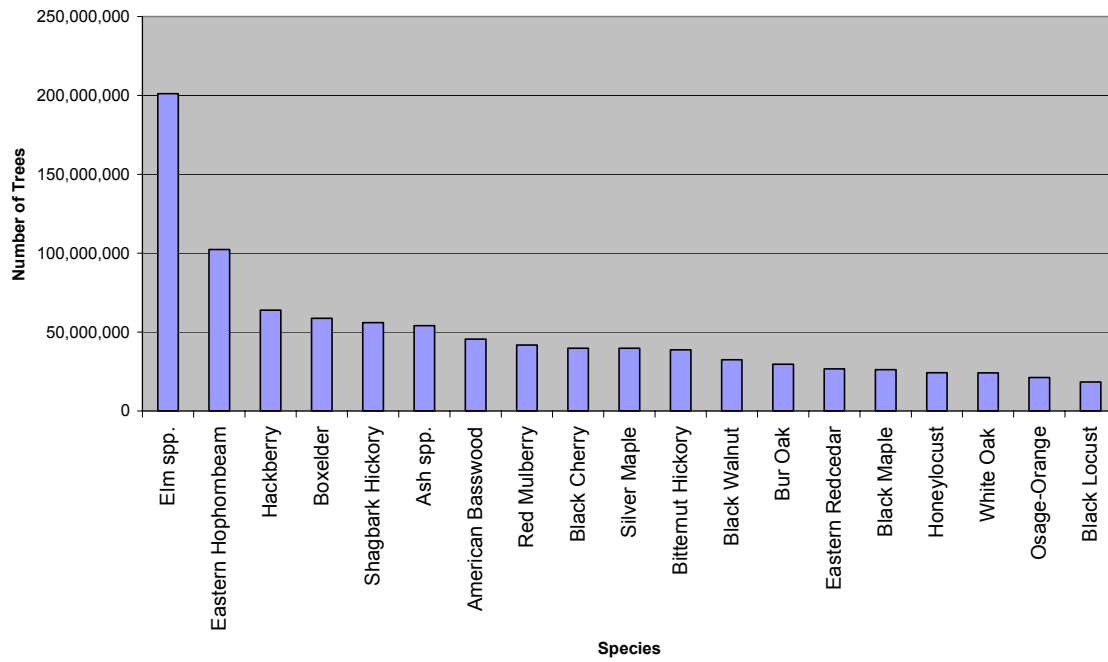


Table 1. Iowa Tree Species Rankings based on the latest Forest Inventory Data (2005)

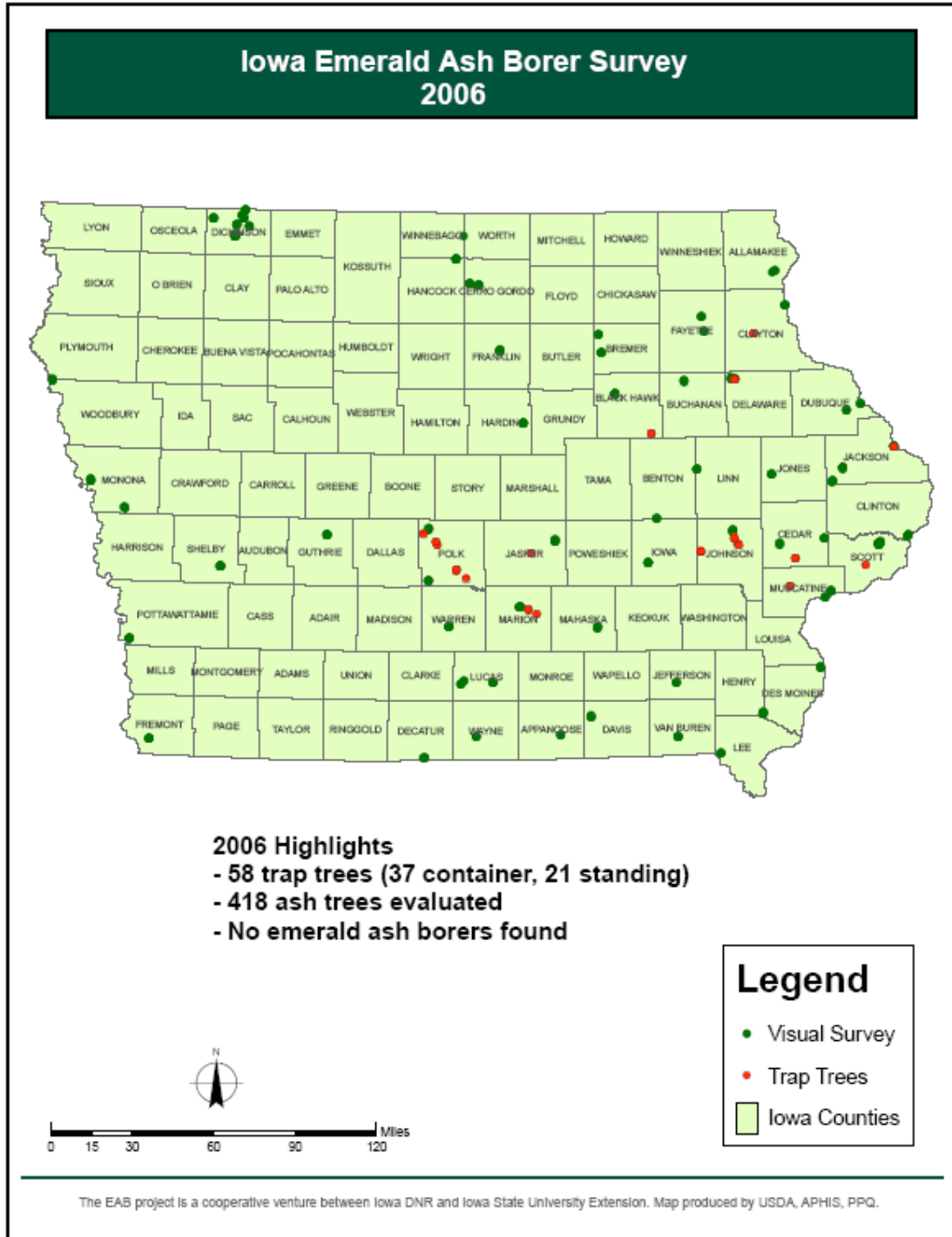
Species	Number of Trees (2005)	Ranking (2005)	Percentage of Iowa Forest
Elm spp.	201,140,824	1	18.34%
Eastern Hophornbeam	102,291,361	2	9.33%
Hackberry	63,899,030	3	5.83%
Boxelder	58,750,295	4	5.36%
Shagbark Hickory	55,977,690	5	5.10%
Ash spp.	54,100,862	6	4.93%
American Basswood	45,509,927	7	4.15%
Red Mulberry	41,738,128	8	3.81%
Black Cherry	39,754,839	9	3.62%
Silver Maple	39,693,734	10	3.62%
Bitternut Hickory	38,701,546	11	3.53%
Black Walnut	32,391,437	12	2.95%
Bur Oak	29,561,031	13	2.70%
Eastern Redcedar	26,725,567	14	2.44%
Black Maple	26,129,369	15	2.38%
Honeylocust	24,169,201	16	2.20%

Species	Number of Trees (2005)	Ranking (2005)	Percentage of Iowa Forest
White Oak	24,083,811	17	2.20%
Osage-Orange	21,215,051	18	1.93%
Black Locust	18,361,701	19	1.67%
Sugar Maple	17,844,181	20	1.63%
Northern Red Oak	16,083,951	21	1.47%
Shingle Oak	15,321,941	22	1.40%
Black Willow	14,831,230	23	1.35%
Hawthorn	11,527,944	24	1.05%
Ohio Buckeye	10,863,849	25	0.99%
American Hornbeam	10,772,754	26	0.98%
Wild Plum	9,964,643	27	0.91%
Black Oak	7,645,108	28	0.70%
Eastern Cottonwood	6,675,187	29	0.61%
Serviceberry	4,053,631	30	0.37%
River Birch	3,669,320	31	0.33%
Eastern Redbud	2,999,129	32	0.27%
Chokecherry	2,903,396	33	0.26%
Northern Pin Oak	2,395,430	34	0.22%
Mockernut Hickory	2,299,943	35	0.21%
Quaking Aspen	2,011,588	36	0.18%
Paper Birch	1,809,194	37	0.16%
Chinkapin Oak	1,203,518	38	0.11%
Cockspur Hawthorn	1,170,554	39	0.11%
Bigtooth Aspen	999,786	40	0.09%
Swamp White Oak	965,486	41	0.09%
Sycamore	753,565	42	0.07%
Pin Oak	667,678	43	0.06%
Butternut	658,964	44	0.06%
Red Maple	410,096	45	0.04%
Ponderosa Pine	285,926	46	0.03%
Northern Catalpa	239,799	47	0.02%
Pignut Hickory	200,746	48	0.02%
White Willow	175,227	49	0.02%
Russian Olive	161,565	50	0.01%
Apple spp.	149,925	51	0.01%
Willow	141,013	52	0.01%
Post Oak	120,266	53	0.01%
Tamarack	101,599	54	0.01%
Red Pine	87,480	55	0.01%
White Mulberry	75,006	56	0.01%
Larch (Introduced)	74,538	57	0.01%
Ailanthus	40,767	58	0.00%
Downy Hawthorn	40,391	59	0.00%
White Pine	40,391	60	0.00%
Peach Leaf Willow	32,457	61	0.00%
Scotch Pine	32,457	62	0.00%
Total Number of Trees	1,096,697,023		

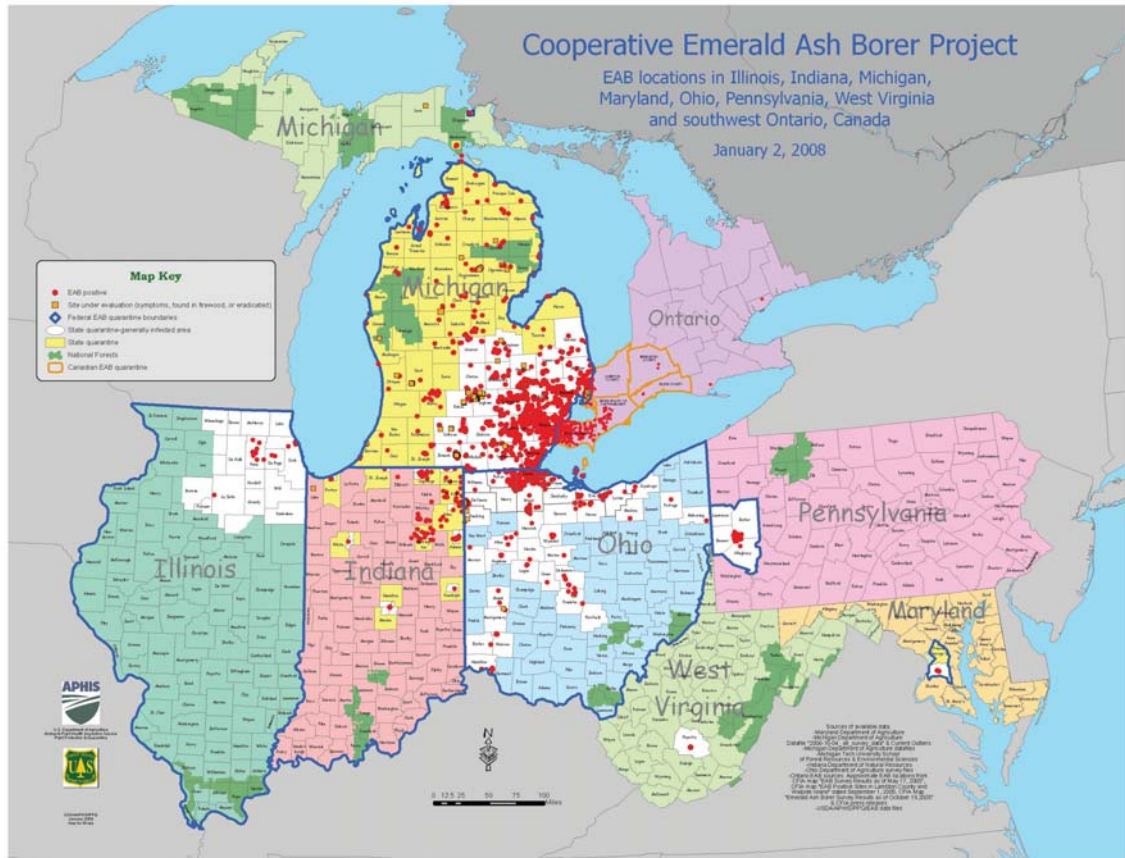
Note Green Color means these species went down from the 2004 inventory.

Appendix B

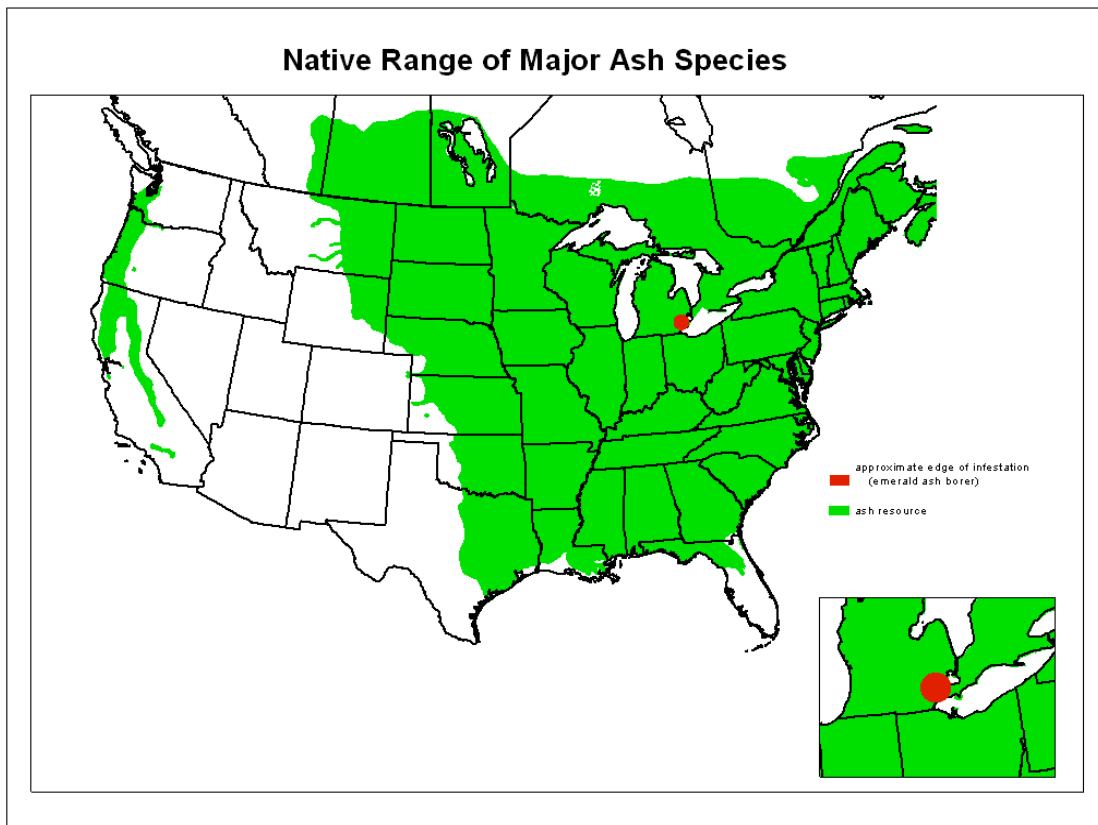
Map 1. Iowa Emerald Ash Borer Visual Survey Locations and Sentinel Tree Placement for 2006. *Note the 2007 map was not available at the time of writing this report.*



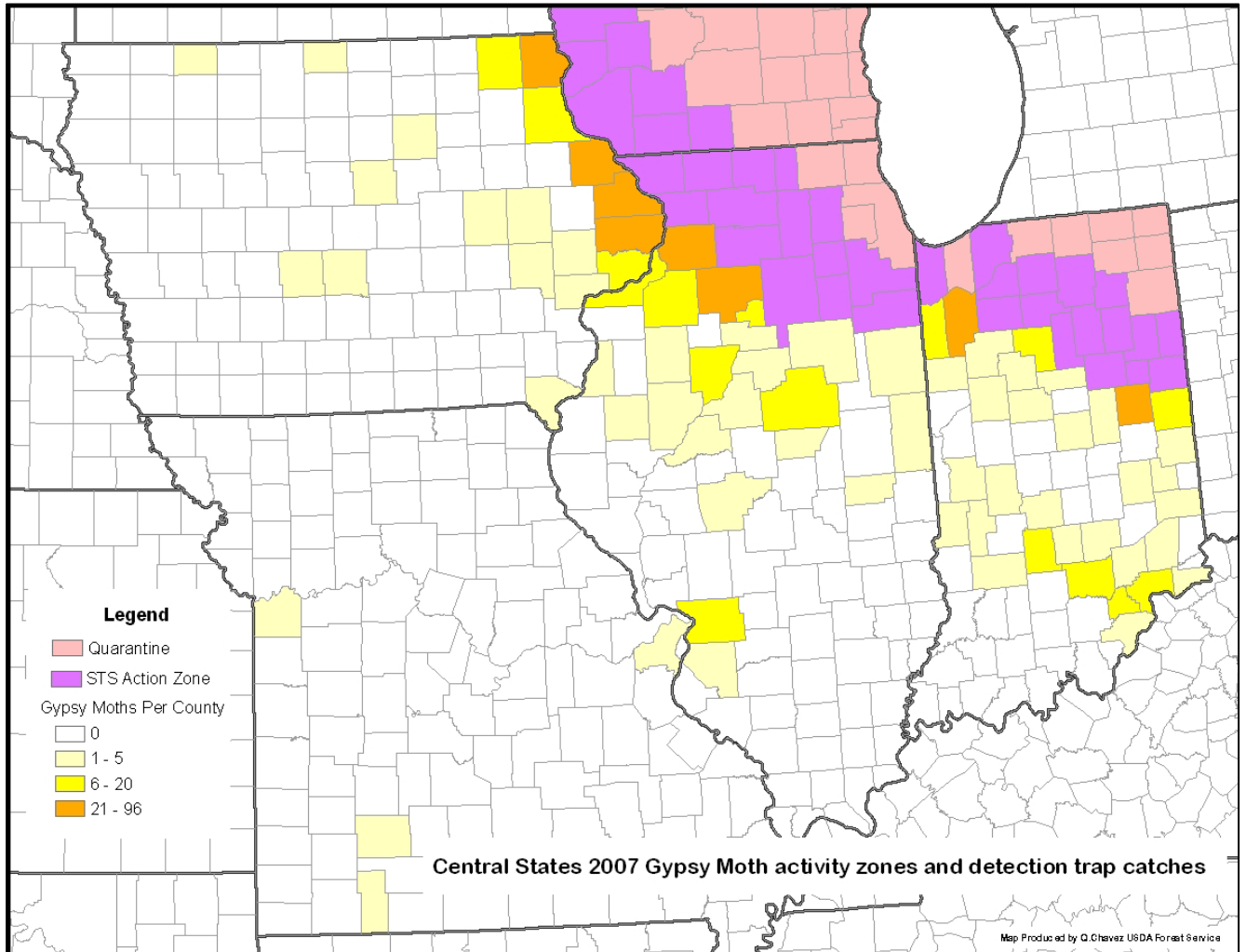
Map 2. Current known Emerald Ash Borer sites as of January 2, 2008 in North America.



Map 3. Distribution of Ash in the United States is highlighted in Green.



Map 1. Gypsy Moth Summary Map Showing Trap Catch Distribution Patterns and Where Male Moths were Caught in the Midwest. See Legend for color definitions.



Map 2. Gypsy Moth Summary Map Showing Trap Distribution Patterns and Where Male Moths were Caught in Iowa.



2007 Gypsy Moth Traps - Iowa

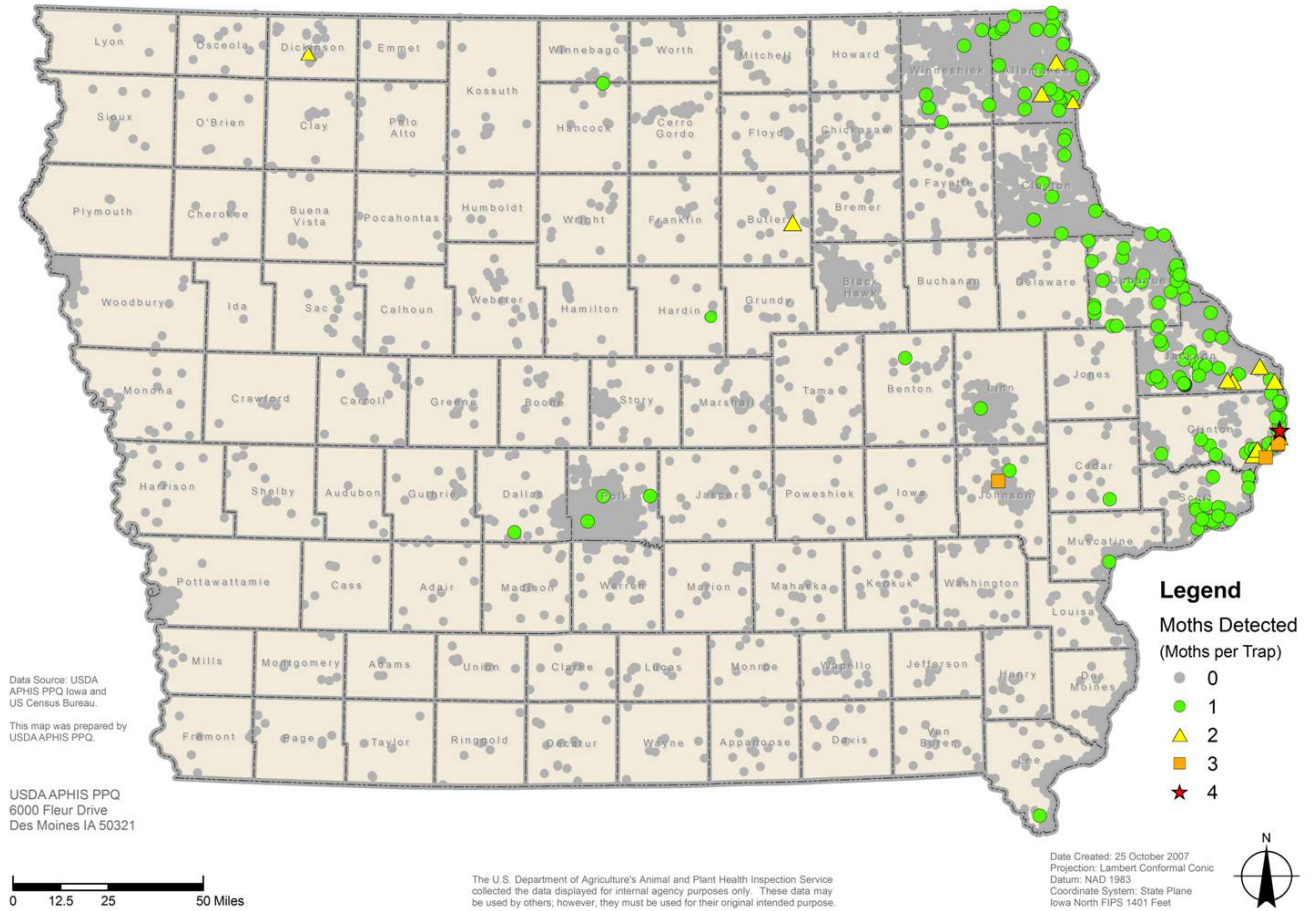


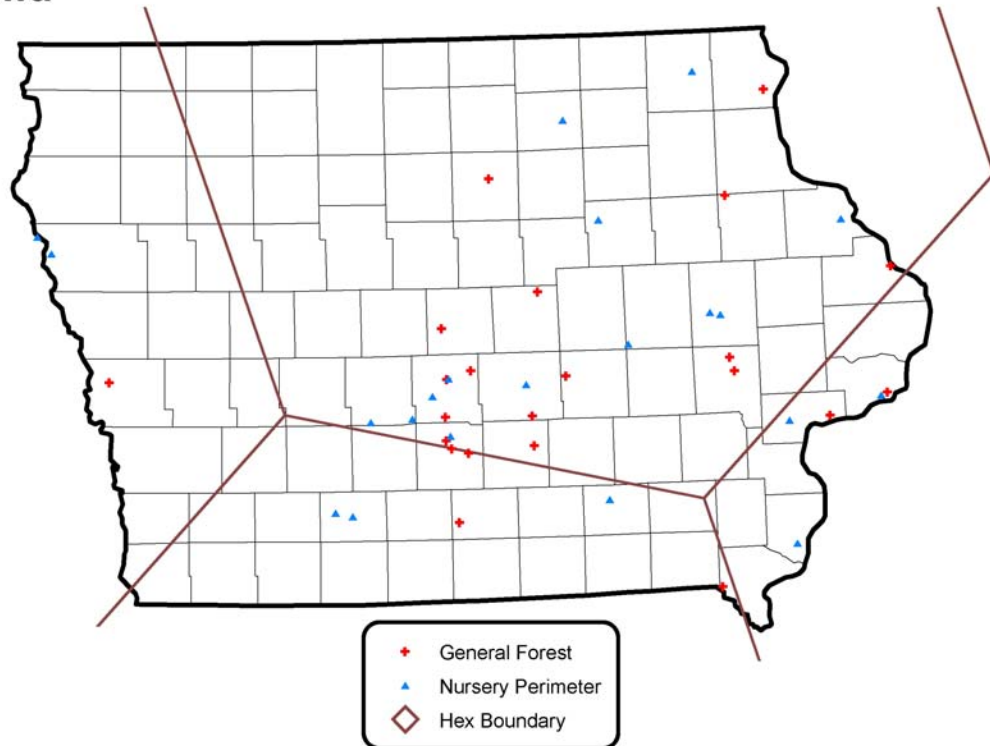
Table 1: History of the Number of Gypsy Moth Catches and the Number of Acres Treated for gypsy moth eradication in Iowa (1972-2007). Unless specified, *Bacillus thuringiensis* var. *kurstaki* was the treatment method.

Year	Number of Traps used in Survey	Number of Multiple Catches	Total Number of Moths Caught	Number of Acres Treated
1972	253		1	
1973	1196		0	
1974	1210		1	
1975	1120		0	
1976	1650		0	
1977	1130		0	
1978	741		1	
1979	854		0	
1980	676		1	
1981	970		6	
1982	1123		11	
1983	1617		14	
1984	3585		10	
1985	2538		6	
1986	3217		15	
1987	3084		18	
1988	2259		13	
1989	2858		27	9
1990	2760		17	0
1991	2775		61	0
1992	4738		162	21
1993	4800		72	73.5
1994	5797		143	90
1995	6324		76	52
1996	5241		104	25
1997	5899		151	10
1998	7093		371	21.3
1999	7532		135	224 (pheromone flakes)
2000	6834		47	42
2001	5729		26	15
2002	5729		35	2
2003	3068		159	3 (carbaryl)
2004	4374		27	26
2005	4996		4	0
2006	4891		20	0
2007	5116		175	0

Appendix D

Map 1. Summary of Sites Surveyed for SOD in 2003-2005 for Iowa.

Forest Survey Sites 2003 - 2005 Iowa



Appendix E

Known Invasive Plants in Iowa 2007

Key: NP= Not Present- Not known to exist in Iowa

I= Isolated- the species is infrequent, not commonly seen

LA= Locally Abundant- the species is present but is not in the majority of the counties

W= Widespread- commonly seen in the majority of counties in large or small populations

Species	Common Name	Abundance
<i>Abutilon theophrasti</i>	velvetleaf	W
<i>Ailanthus altissima</i>	tree-of-heaven	W
<i>Alliaria petiolata</i>	garlic mustard	LA
<i>Berberis thunbergii</i>	Japanese barberry	W
<i>Bromus tectorum</i>	cheatgrass	W
<i>Butomus umbellatus</i>	flowering rush	NP
<i>Carduus acanthoides</i>	plumeless thistle	I
<i>Carduus nutans</i>	Musk thistle	W
<i>Celastrus orbiculata</i>	Oriental bittersweet	I
<i>Centaurea maculosa/ biebersteinii</i>	spotted knapweed	LA
<i>Centaurea repens</i>	Russian knapweed	I
<i>Centaurea solstitialis</i>	yellow starthistle	I
<i>Cirsium arvense</i>	Canada thistle	W
<i>Cirsium spp.</i>	thistle	W
<i>Cirsium vulgare</i>	bull thistle	W
<i>Conium maculatum</i>	poison hemlock	I
<i>Coronilla varia</i>	crown vetch	W
<i>Daucus carota</i>	Queen Anne's lace	W
<i>Dipsacus fullonum/sylvestris</i>	common teasel	I
<i>Dipsacus laciniatus</i>	cutleaf teasel	I
<i>Dipsacus sativus</i>	Indian teasel	NP
<i>Elaeagnus angustifolia</i>	Russian olive	I
<i>Elaeagnus umbellata</i>	autumn olive	LA
<i>Euonymus alatus</i>	burning bush	I
<i>Euphorbia esula</i>	leafy spurge	W
<i>Fallopia japonica/ Polygonum cuspidatum</i>	Japanese knotweed	LA
<i>Frangula alnus/Rhamnus frangula</i>	glossy buckthorn	I
<i>Heracleum mantegazzianum</i>	giant hogweed	NP
<i>Hesperis matronalis</i>	dame's rocket	W
<i>Lespedeza cuneata</i>	Sericea lespedeza	I
<i>Ligustrum japonicum</i>	Japanese privet	NP
<i>Ligustrum obtusifolium</i>	blunt-leaved or border privet	I
<i>Ligustrum sinense</i>	Chinese privet	NP
<i>Ligustrum vulgare</i>	common or European privet	I
<i>Lonicera fragrantissima</i>	fragrant honeysuckle	NP
<i>Lonicera japonica</i>	Japanese honeysuckle	LA
<i>Lonicera maackii</i>	Amur honeysuckle	W

Species	Common Name	Abundance
<i>Lonicera morrowii</i>	Morrow's honeysuckle	I
<i>Lonicera standishii</i>	Standish's honeysuckle	NP
<i>Lonicera tatarica</i>	Tatarian honeysuckle	W
<i>Lonicera x bella</i>	Bell's honeysuckle	I
<i>Lonicera xylosteum</i>	European fly honeysuckle	NP
<i>Lythrum salicaria</i>	purple loosestrife	W
<i>Morus alba</i>	white mulberry	W
<i>Pastinaca sativa</i>	wild parsnip	W
<i>Potamogeton crispus</i>	curlleaf pondweed	I
<i>Pueraria montana</i>	kudzu	I
<i>Rhamnus cathartica</i>	common buckthorn	W
<i>Rosa multiflora</i>	multiflora rose	W
<i>Tamarix spp.</i>	salt cedar	I

Appendix F

Herbicides on Leaves by LC/MS LTQ at White Pine Hollow, 2006

Chemical	Date	Concentration (ng/g)	Visual conditions when leaves were sampled
Acetochlor	4/20/06	0.64	Oak leaf buds taken from 5 mature white oaks
Alachlor	4/20/06	<0.8	
Butachlor	4/20/06	<0.8	
Dimethenamid	4/20/06	0.64	
Metolachlor	4/20/06	1.0	
Propachlor	4/20/06	<2.0	
Acetochlor	4/27/06	2.0	Leaves & flowers look healthy, leaf samples collected from 2 different white oak trees
Alachlor	4/27/06	<0.88	
Butachlor	4/27/06	<0.88	
Dimethenamid	4/27/06	0.79	
Metolachlor	4/27/06	1.3	
Propachlor	4/27/06	<2.2	
Acetochlor	5/3/06	43	Damaged, unprotected, white oak leaves sampled from 2 white oak trees with pole pruner
Alachlor	5/3/06	<1.1	
Butachlor	5/3/06	<1.1	
Dimethenamid	5/3/06	0.91	
Metolachlor	5/3/06	6.7	
Propachlor	5/3/06	<2.9	
Acetochlor	5/11/06	50	Unprotected white oak leaves
Alachlor	5/11/06	<0.8	
Butachlor	5/11/06	<0.8	
Dimethenamid	5/11/06	1.2	
Metolachlor	5/11/06	7.3	
Propachlor	5/11/06	2.0	
Acetochlor	5/11/06	50	Unprotected white oak leaves
Alachlor	5/11/06	<0.8	
Butachlor	5/11/06	<0.8	
Dimethenamid	5/11/06	1.2	
Metolachlor	5/11/06	7.3	
Propachlor	5/11/06	<2.0	
Acetochlor	5/11/06	1.9	Unprotected hackberry leaves
Alachlor	5/11/06	<1.1	
Butachlor	5/11/06	<1.1	
Dimethenamid	5/11/06	<0.57	
Metolachlor	5/11/06	5.2	

Chemical	Date	Concentration (ng/g)	Visual conditions when leaves were sampled
Propachlor	5/11/06	<2.8	
Acetochlor	5/11/06	37	Unprotected red oak leaves, showing some damage
Alachlor	5/11/06	<0.8	
Butachlor	5/11/06	<0.8	
Dimethenamid	5/11/06	0.76	
Metolachlor	5/11/06	7.3	
Propachlor	5/11/06	<2.0	
Acetochlor	5/11/06	33	Unprotected white oak leaves
Alachlor	5/11/06	<0.8	
Butachlor	5/11/06	<0.8	
Dimethenamid	5/11/06	.76	
Metolachlor	5/11/06	7.8	
Propachlor	5/11/06	<2.0	
Acetochlor	5/11/06	5.6	Protected leaves from protected bag
Alachlor	5/11/06	<0.8	
Butachlor	5/11/06	<0.8	
Dimethenamid	5/11/06	<0.4	
Metolachlor	5/11/06	2.4	
Propachlor	5/11/06	<2.0	
Acetochlor	5/18/06	15	Unprotected white oak leaves
Alachlor	5/18/06	<0.8	
Butachlor	5/18/06	<0.8	
Dimethenamid	5/18/06	<0.4	
Metolachlor	5/18/06	18	
Propachlor	5/18/06	<2.0	
Acetochlor	5/18/06	<0.8	Protected white oak leaves
Alachlor	5/18/06	<0.8	
Butachlor	5/18/06	5.6	
Dimethenamid	5/18/06	<0.4	
Metolachlor	5/18/06	<0.4	
Propachlor	5/18/06	<2.0	

Herbicides on Leaves by LC/MS LTQ at Iowa City, 2006

Chemical	Date	Concentration (ng/g)	Visual conditions when leaves were sampled
Acetochlor	5/3/06	6.7	Unprotected white oak leaves
Alachlor	5/3/06	<0.8	
Butachlor	5/3/06	<0.8	
Dimethenamid	5/3/06	0.56	
Metolachlor	5/3/06	6.3	
Propachlor	5/3/06	<2.0	
Acetochlor	5/9/06	9.3	Unprotected white oak leaves
Alachlor	5/9/06	<0.8	
Butachlor	5/9/06	<0.8	
Dimethenamid	5/9/06	0.8	
Metolachlor	5/9/06	3.5	
Propachlor	5/9/06	<2.0	
Acetochlor	5/16/06	<0.8	Protected bur oak leaves
Alachlor	5/16/06	<0.8	
Butachlor	5/16/06	6.7	
Dimethenamid	5/16/06	<0.4	
Metolachlor	5/16/06	4.3	
Propachlor	5/16/06	<2.0	
Acetochlor	5/16/06	6.6	Unprotected bur oak leaves
Alachlor	5/16/06	<0.8	
Butachlor	5/16/06	11	
Dimethenamid	5/16/06	0.8	
Metolachlor	5/16/06	3.5	
Propachlor	5/16/06	<2.0	
Acetochlor	5/16/06	13	Unprotected bur oak leaves
Alachlor	5/16/06	<0.8	
Butachlor	5/16/06	<0.8	
Dimethenamid	5/16/06	0.92	
Metolachlor	5/16/06	5.4	
Propachlor	5/16/06	<2.0	